

REMARKS

Claims 1-39 are presently pending in this application. Claims 1, 3, 5, 13, 17, 19, 20, 21, 22, 24, 34, and 37 have been amended to more particularly define the invention.

Claims 1, 5, 9, 10, 15-18, 21, 22, 26, 30, 31, 36, 38, and 39 were rejected under 35 U.S.C. §112, first paragraph. Claims 1, 3-6, 8, 11-14, 17, 19, 20, 22, 24-27, 29, 32-35, and 37 were under 35 U.S.C. §112, second paragraph. Claims 1, 2, and 7 were rejected under 35 U.S.C. §102(e) as being anticipated by Shenoy, United States Patent No. 6,378,114. All the rejections are respectfully traversed in the following discussion.

In one aspect, Applicants' invention is a method of applying transforms for simultaneously modifying a plurality of domains of a circuit, including at least one of a Boolean domain, an electrical domain, and a physical domain, concurrently in a design space. Applicants' invention also comprises a system for modifying a plurality of domains concurrently in a design space, and software or a programmable storage medium with instructions for modifying a plurality of domains concurrently in a design space.

In accordance with one embodiment of Applicants' method, a set of less-to-more granular placement and netlist modification transforms are selectively applied separately or in a flexible sequence. The impact of the set of modification transforms on the design space is evaluated, and those evaluated transforms that do not improve the design space are rejected. This method is repeated to create a converging design process flow. The transforms comprise fine-grained steps to optimize the netlist and placement properties of the design.

The Office Action devotes some 42 numbered paragraphs to rejections under 35 U.S.C. §112. In its paragraph 10, the Office Action states that Applicants' representation of the prior art's sequential optimization as traveling sequentially from point to point in

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directions parallel with the axes is not fully accurate because the axes are interactive. It is recognized that the Boolean, electrical, and physical domains are interrelated. At page 4, lines 18 and 19, Applicants' specification states that Figure 1 illustrates a graph which serves to describe the traditional methods. Applicants do not contend that Figure 1 accurately depicts all performances of the traditional methods.

In its paragraph 12, the Office action contends that the statement at page 9, lines 17-19 that "a single step may optimize the physical, Boolean and electrical dimensions, thus moving the design from point A to F in the design space" is not supported and that changes to a single domain must be propagated sequentially to the other domains. This dismisses Applicants' invention. Then in subsequent paragraphs, with reference to claims 1, 5, 6, 10, 15, 16, 18, 21, 22, 26, 31, 36, and 39, the Office Action contends that "concurrently" and "concurrent" and "a single transform" and "performed together" fail to satisfy 35 U.S.C. §112, first paragraph. This contention and the rejection based on it are traversed.

The Boolean, physical, and electrical domains do indeed interact in a complex, non-linear and unpredictable fashion. This makes the problem of timing optimization, and in general design optimization, extremely difficult. Applicants' invention addresses exactly the problem associated with this complexity and non-linearity. The invention does so by evaluating the effects of any change in all three domains. Applicants' invention will not apply a change to the design unless the change satisfies the improvement requirements in all three domains.

As an illustration, Applicants' invention will consider a change in, say, logic function. The effects of the change are evaluated for its cost in all three domains. For example, for the logic change, considerations would include whether application of the logic change within the

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design would (a) impact on speed, (b) impact on layout area, (c) impact on congestion, and (d) impact on noise. If the evaluation confirms that the optimization meets all of the criteria with respect to these evaluations, the optimization is applied. Otherwise, the proposed change is rejected. Thus, Applicants' invention assures that various metrics are optimized concurrently with the application of any given single optimization.

With reference to claims 8, 13, 17, 21, 29, 38, and 39, the Office Action also questions the usage of "converge" or "convergence." These are recognized terms. See, for example, the Shenoy reference at column 3, lines 52-55.

It is accordingly submitted that the claims satisfy 35 U.S.C. §112, first paragraph, and that the rejection based on that statute section should be withdrawn.

The rejection under 35 U.S.C. §112, second paragraph, contends that several expressions in the claims are indefinite. The first of these is "more and less" from claims 1 and 37. That expression is found in some other claims as well. However, to clarify the Examiner's confusion, this expression has been corrected to "less-to-more granular." That is, a set of placements and netlist transforms are being provided which at one end of the set are less granular and at the other end of the set are more granular.

Next the Office Action cites from claim 3 "a function of said placement and synthesis transforms are decomposed ..." The Office Action questions whether the function or the transforms are (or is) decomposed. The Office Action also contends that "a function" and "decomposed" are not adequately defined. The claims have been amended to delete "function". As is recognized in the art, "decomposed" means division of a larger item into a series of smaller items. See, for example, the Shenoy reference at column 1, lines 18-20.

With reference to claim 4, the Office Action contends that "selectively mixed and

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matched predetermined” is not adequately defined. Claim 4, in fact, includes “said placement transforms are selectively mixed and matched with predetermined logic synthesis transforms and fine-grained transforms.” In any event, once a large step is divided into a set of smaller (fine-grained) transformations, a combination of the smaller steps may be used in various permutations and combinations based on the optimization required. For example, a timing optimization may require one set of steps, while an area optimization may require a different set of steps. It is submitted that claim 4 brings this out and is adequately definite to satisfy 353 U.S.C. §112.

The Office Action questions the expression “selectively optimizes” in claims 5 and 22. The above amendments including deleting the word “selectively,” thus mooted this question.

With respect to claim 11, the Office Action questions how the “fine-grained transforms are organized together in flexible scenarios to create a design closure process.” During synthesis, various transformations are applied one after another on a design. The sequence of transformations comprises a scenario. The sequence may be organized in such a fashion as to select various transformations most suited to the state of the design and can therefore be made flexible. Just as when other goals are met, closure is achieved, so too when design goals, such as timing, area, noise, etc., have been met, “design closure” has been achieved or created.

With respect to claim 12, the Office Action questions which stages are predetermined, how the selective determination is made, and how to “intercept” a process. In a “scenario,” as described above, an “if” statement may be inserted which will select a different set of transformations based on the outcome of the “if.” The “if” may be decided based on the state

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of the design. Therefore, the interception of the state of the design is performed by the conditional operators in the scenario, such as “if-then-else” or “case” statements.

As to claim 14, the Office Action contends that “unified view” is unclear in the context in which it is used. A “unified view” refers to a common database repository and application programming interface for all data regarding the design - - Boolean, electrical, and physical.

The Office Action contentions as to other claims are discussed above with reference to related claims, just as the contentions as to those other claims are set forth in the Office Action with reference to the other claims.

In view of the above, it is respectfully submitted that the claims satisfy 35 U.S.C. §112, second paragraph, and so the rejection based on that statute section should be withdrawn.

As to the rejection under 35 U.S.C. §102(e), Shenoy discloses a method for the physical placement of an integrated circuit adaptive to netlist changes. Shenoy uses an iterative process in which a partition is changed until optimization is achieved. In rejecting claims 1, 2, and 7, the Office Action sequentially recites the several elements set forth in these claims, and then as to each simply quotes the same portion of a sentence in Shenoy at column 3, line 32, which states: “after cell separation is performed, the netlist is tweaked to optimize the design.” There is no indication in Shenoy of what might be done to “tweak” the netlist. In any event, Shenoy applies optimization in at least two separate steps - - cell separation and “tweaking.” The claimed invention generates many alternatives that take into consideration not only cell separation, but also Boolean and electrical optimizations.

Further the claimed invention considers all three domains -- Boolean, electrical, and

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physical - - concurrently. The physical aspects might include single cell movement, shape modification, size modification, for example.

Additionally, the amendment to claim 1 includes steps which further distinguish over Shenoy, as well as aiding in overcoming the rejections under 35 U.S.C. §112.

In view of the foregoing, Applicant submits that claims 1-39, all the claims presently pending in the application, are patentably distinct over the prior art of record and that the application is in condition for allowance. Such action would be appreciated.


The above-described drawing corrections conform the drawings to the specification.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

To the extent necessary, Applicant petitions for an extension of time under 37 C.F.R. §1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Assignee's Deposit Account No. 50-0510 and please credit any excess fees to such deposit account.

Date: 12/23/03

Respectfully Submitted,

 Reg # 34,386
James N. Dresser, Esq.
Registration No. 22,973

McGinn & Gibb, PLLC
8321 Old Courthouse Road, Suite 200
Vienna, VA 22182-3817
(703) 761-4100
Customer No. 21254